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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/039,991	01/08/2002	Wayne S. Steffier	HTI-101CIP	1235

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EXAMINER	
EGAN, BRIAN P	
ART UNIT	**PAPER NUMBER**
1772	4

DATE MAILED: 11/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/039,991	STEFFIER, WAYNE S.	
	Examiner	Art Unit	
	Brian P. Egan	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 August 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Interpretation

1. Claim 4 presents no structural limitations and is directed solely at the method of fabricating the textiles for the fibrous perform. The method of forming the fiber is not germane to the issue of patentability of the article itself. Therefore, this limitation has not been given patentable weight.

The Examiner notes the Applicant's contention that Claim 4 is a product-by-process claim. Even though product-by-process claims are limited by and defined by the process, however, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *See In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-16 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Haidn (#6,151,887) in view of Smith (#5,523,133).

Haidn teaches a ceramic matrix composite tubular shell structure comprising an inner wall, an outer wall, and a plurality of cooling channels formed between the inner wall and the outer wall (Figs. 1-2) wherein the ceramic matrix composite tubular shell structure comprises carbon fibers embedded into a carbon matrix (Col. 3, lines 37-41). The tubular shell has a tubular geometry with the plurality of cooling channels annularly arranged around and formed between the inner and outer walls (Fig. 2). The tubular shell comprises a rocket propulsion thrust chamber having a converging-diverging geometric profile with the plurality of cooling channels having a corresponding converging-diverging geometric profile formed between the inner and outer walls of the rocket propulsion thrust chamber (Fig. 1). The plurality of cooling channels are oriented axially with respect to the longitudinal axis of the tubular shell structure (Fig. 1). The plurality of cooling channels are further oriented in parallel alignment and since they follow the pattern of the converging-diverging geometry of the wall sections, the channels undulate sinusoidally with respect to the longitudinal axis (Fig. 1). The cooling channels are nested in an annular assemblage between the inner and outer walls and are in intimate contact with the inner and outer walls (Fig. 2). The cooling channels form a corresponding plurality of radial webs by which to mechanically couple the inner wall and outer wall into a high efficiency monocoque structure (Figs. 1-2). Haidn teaches that the inventive process offers the advantage that the combustion chamber casing is formed as an integral structure from an inner shell comprising a fibrous ceramic material and from an outer shell comprising a fiber reinforced silicon carbine without subsequent joining steps being necessary to join individual components together (Col. 6, lines 28-33) – therefore, the refractory fibers extend continuously throughout the inner and outer walls and around the plurality of cooling channels. Haidn teaches that the

cooling channels have a semicircular cross section but that the cross section can be modified in shape depending on the desired end product. Therefore, it would have been obvious to one of ordinary skill in the art to have modified the semi-circular shape such that the cylindrical ceramic matrix composite tubular shell and the cooling channels have corresponding cylindrical profiles or such that the cooling channels have a trapezoidal-shaped cross sectional geometry (Col. 10 ,lines 45-50).

Haidn fails to explicitly teach the specific physical structure of the wall material and therefore fails to teach a fibrous preform of refractory fibers coated with a fiber coating which fully encapsulates the refractory fibers of the preform, the preform and fiber coating also being encapsulated by a ceramic matrix material.

Smith, however, teaches a high temperature ceramic composite comprising a fibrous preform of refractory fibers wherein the refractory fibers are ceramic oxide fibers that are formed into a desired shape using conventional techniques including braiding, knitting, weaving, and winding (Col. 6, lines 21-28) – thus, depending on the formation process, the refractory fibers are arranged as either continuous (braiding, knitting, weaving) or discontinuous high-temperature fibers (winding). The refractory fibers are able to withstand temperatures up to 1500°C (Col. 5, lines 28-36). The perform of refractory fibers is coated with a fiber coating which fully encapsulates the refractory fibers of the fibrous perform ("carbonaceous matrix" – Col. 3, lines 18-55; Col. 4, lines 47-55). The fiber coating is a material having a thickness of between 0.05 and 5 micrometers (Col. 3, lines 39-41) and comprises both amorphous carbon and boron nitride particles (Col. 3, lines 34-55). Since the boron nitride particles are either embedded into the amorphous carbon or attached or adhered to a surface of the amorphous carbon (Col. 3, lines 53-

55), the fiber coating can be both a single-layer phase of uniform or mixed material composition, or can be a multilayered phase including two or more alternating coating layers having two or more fiber coating material compositions. The fiber coating is encapsulated by a ceramic matrix material comprising silicone carbide (Col. 4, lines 12-18 and 63-66). The ceramic matrix material comprises a single phase of material composition. Although Smith only teaches a single-phased material composition, it would have been obvious to one of ordinary skill in the art to have provided a multi-layered phase, since it has been held that constructing a formerly integral structure in various elements involves only routine skill in the art, *Nerwin v. Erlichman*, 168 USPQ 177, 179, and it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious optimization absent demonstration of unexpected results. *In re Leshin*, 125 USPQ 416. Smith teaches the aforementioned material arrangement for the purpose of providing a ceramic matrix composite that is improved in both high temperature performance and mechanical properties (Col. 1, line 66 to Col. 2, line 2; Col. 9, lines 36-39). It would have been obvious through routine experimentation to one of ordinary skill in the art at the time Applicant's invention was made to have modified a ceramic matrix composite tubular shell with a multilayered structure comprising a fibrous perform of refractory fibers coated with both a fiber coating and a ceramic matrix material for the purpose of providing a ceramic matrix composite that is improved in both high temperature performance and mechanical properties as taught by Smith.

Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified Haidn et al. to include a multilayered ceramic

matrix composite as taught by Smith in order to provide a ceramic matrix composite that is improved in both high temperature performance and mechanical properties.

4. Claims 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Haidn (#6,151,887) in view of Smith (#5,523,133), and further in view of McAninch et al. (#5,221,045).

Haidn and Smith teach a ceramic matrix composite tubular shell as detailed above. The aforementioned prior art fails to explicitly state that the cooling channels may be oriented helically with respect to the longitudinal axis of the tubular shell structure.

McAninch et al., however, teach helically wound cooling channels for a rocket nozzle (Col. 1, lines 14-18; Fig. 1). McAninch et al. teach the helical orientation for the purpose of providing cooling channels wherein the channel area is able to remain constant along the nozzle length and to provide increased cooling capacity (Col. 4, lines 53-56). It would have been obvious through routine experimentation to have rearranged the orientation of cooling channels in a ceramic matrix composite such that they are helically oriented for the purpose of providing increased cooling capacity and providing cooling channels whose area is able to remain constant along the nozzle length as taught by McAninch et al.

Therefore, it would have been obvious to one of ordinary skill in the art at the time Applicant's invention was made to have modified the aforementioned prior art by orienting the cooling channels helically about the tubular shell as taught by McAninch et al. in order to provide increased cooling capacity and to provide cooling channels whose area is able to remain constant along the nozzle length. Furthermore, even in the absence of the teachings of McAninch et al., it would have been obvious to one of ordinary skill in the art at the time

Applicants invention was made to have arranged the cooling channels helically about the tubular shell, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse*, 86 USPQ 70.

Response to Arguments

5. Applicant's arguments filed August 8, 2003 have been fully considered but they are not persuasive.

First, the Examiner notes that pursuant to the Applicant's amended claims, the 35 U.S.C. 112, second paragraph rejections from the previous office action have been withdrawn.

Second, with regards to the 35 U.S.C. 103(a) rejection of claims 1-20 over Haidn et al., Smith, and McAninch et al. (only claim 17), the Applicant's primary contention is that Haidn et al. fails to teach an integrally connected monocoque structure as claimed by the Applicant, and instead teaches "a multiple piece structure ... wherein separate and distinct inner and outer shell pieces are bonded together by means of molten silicon to define an interface therebetween." The Examiner respectfully disagrees with the Applicant's reading of Haidn et al. Although Haidn et al. do make use of an inner and outer wall structure, the end product is formed in such a way that an integral structure is created. Namely, the inventive process for the production of the combustion chamber comprises: producing an inner sheel preliminary member from a fiber reinforced plastic, pyrolizing the inner shell preliminary member, applying an outer shell preliminary member consisting of fiber reinforced plastic to the pyrolyzed inner shell preliminary member, and supplying silicon to the pyrolyzed outer shell preliminary member to form a silicon carbide matrix in the material of the outer shell (Col. 6, lines 13-27). Haidn et al.

continue by stating that the inventive process offers the advantage that the combustion chamber casing is formed as an integral structure from an inner shell comprising a fibrous ceramic material and from an outer shell comprising a fiber reinforced silicone carbide without subsequent joining steps being necessary to join individual components together (Col. 6, lines 28-33). Therefore, the structure produced by Haidn et al. is an integral monocoque structure comprising refractory fibers that extend continuously throughout the structure. The continuous distribution of refractory fibers is further suggested via the obvious modification of the fibers with the teachings of Smith as detailed above. Finally, it is unclear where the Applicant's are defining Haidn et al. as teaching the inner and outer walls being bonded by molten silicon – the method as detailed above details the use of silicon to establish a silicone carbide matrix about the structure but it does not state that the inner and outer walls are bonded via silicone.

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Related Prior Art

7. Although not relied upon in any of the above rejections, the Examiner would like to direct the Applicant's attention to several other prior art references related to the field of the Applicant's invention. These include:

US 4,781,019 (Wagner) – teaching a integral monocoque structure for rocket combustors

US 5,545,435 (Steffier) – teaching the use of multi-layered fibrous coatings

US 6,182,442 (Schmidt et al.) – teaching silicone carbide combustion chambers

US 5,945,166 (Singh et al.) – teaching fiber reinforced composite bodies

US 5,076,054 (Akimune et al.) – teaching woven and braided silicone carbide composite bodies

US 5,391,428 (Zender) – teaching a high temperature ceramic composite

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian P. Egan whose telephone number is 703-305-3144. The examiner can normally be reached on M-F, 8:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Harold Y. Pyon can be reached on 703-308-4251. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

BPE 10/23/03

HAROLD PYON
SUPERVISORY PATENT EXAMINER
1772

10/31/03